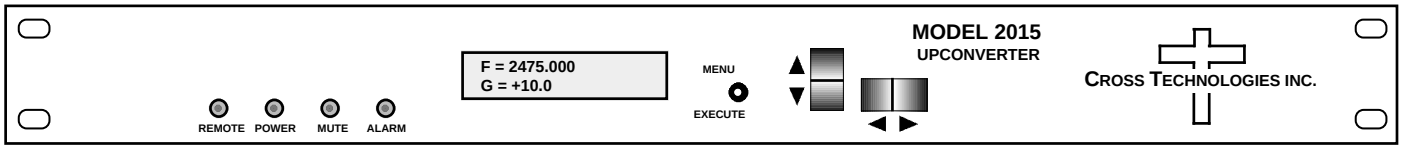
Instruction Manual

Model 2015-25
Upconverter

July 2014, Rev. J



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INSTRUCTION MANUAL

MODEL 2015-25 Upconverter

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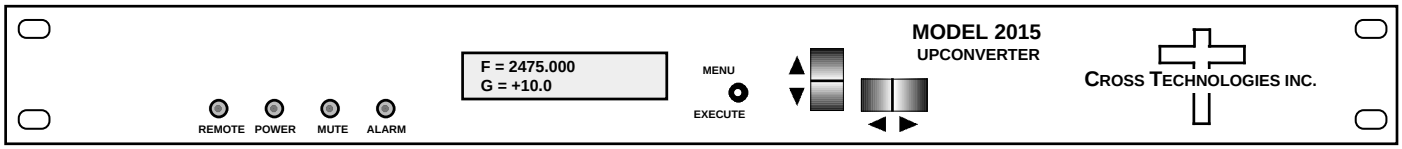
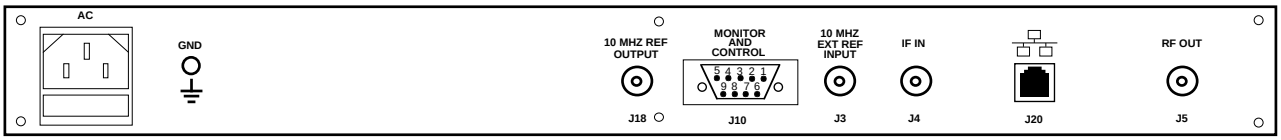
1.0 General

1.1 Equipment Description

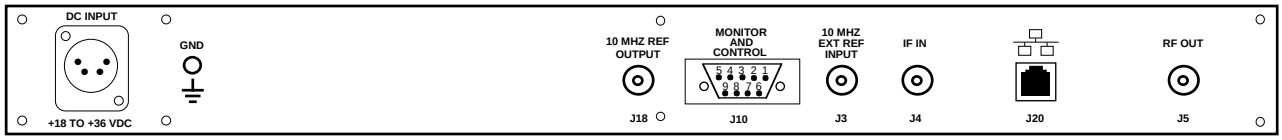
The 2015-25 S-band Upconverter converts 70 ± 18 MHz to 2000 to 2500 MHz in 1 MHz steps (0.5 MHz steps, option -5) with low group delay and flat frequency response. Synthesized local oscillators (LO) provide frequency selection. Multi-function push button switches select the RF frequency, gain, and other parameters. Front panel LEDs provide indication of DC power (green), PLL alarm (red), remote operation (yellow) or the TX carrier is muted (yellow). Variable attenuators for the IF input and output provide a gain range of -10 to +30 dB as adjusted by the front panel multi-function push-button switches. Remote operation allows selection of frequency and gain. Parameter selection and frequency and gain settings appear on the LCD display. Connectors are BNC female for RF, IF and the optional external reference input and output. 10 MHz reference can be inserted on the RF line as an added option. The 10 MHz option includes a 10 MHz output connector which contains either the internal or external 10 MHz reference signal. A high stability (±0.01ppm) option is also available. The unit is powered by a 100-240 ±10% VAC power supply, and housed in a 1 3/4" X 19" X 16" rack mount chassis.



FRONT PANEL



REAR PANEL - AC INPUT



REAR PANEL - DC INPUT

FIGURE 1.1 Model 2015-25 Front and Rear Panels

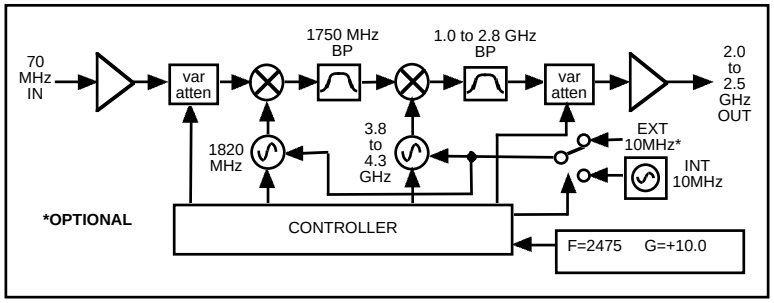


FIGURE 1.2 Model 2015-25 Upconverter Block Diagram

1.2 Technical Characteristics

TABLE 1.1 2015-25 Upconverter Specifications*

Input Characteristics (IF)	
Impedance / Return Loss	75Ω / 18 dB
Frequency	70 ±18 MHz
Input Level Range	-40 to -10 dBm
Output Characteristics (RF)	
Impedance / Return Loss	50Ω / 12 dB
Frequency	2.0 to 2.5 GHz
Output Level	-20 to 0 dBm
Output 1 dB Compression	+5 dBm
Channel Characteristics	
Gain Range (adjustable)	-10 to +30 dB
Image Rejection	> 50 dB, min.
Frequency Response	±1.5 dB, 2.0 - 2.5 GHz; ±0.5 dB, 36 MHz BW
Spurious Response	<-50 dBC, in band
Group Delay, max.	0.015 ns/MHz^2 parabolic; 0.05 ns/MHz linear; 1 ns ripple
Frequency Sense	Non-inverting
Synthesizer Characteristics	
Frequency Accuracy	± 1.0 ppm internal reference (+0.01 ppm, option H)
Frequency Step	1.0 MHz (0.5 MHz to 1 kHz step options available)
10 MHz In/Out Level	3 dBm ± 3 dB, (option - E)

Phase Noise @ F (Hz) >	10	100	1K	10K	100K	1M
Standard-1 MHz Steps: dBC/Hz	-55	-70	-70	-80	-95	-105
X1004-kHz Steps: dBC/Hz	-60	-75	-85	-90	-105	-120

Controls, Indicators	
Frequency / Gain Selection	Direct readout LCD; manual or remote selection
Power, Alarm, Remote, Mute	Green LED, Red LED, Yellow LED, Yellow LED
Remote	RS232C, 9600 baud (RS485 Ethernet Optional)
Other	
RF, IF Connectors	50Ω BNC (female), 75Ω BNC (female)
10 MHz Connectors	BNC (female), 75Ω, works with 50 or 75 ohms (option -E)
Alarm / Remote Connector	DB9 (female) - NO or NC contact closure on Alarm
Size	19 inch, 1RU Standard Chassis 1.75” high X 16.0” deep
Power	100-24 ±10% VAC, 47-63 Hz, 45 watts max. (24 and 48 VDC Optional)

Available Options	
- E	External 10 MHz Ref. Input & Output
- H	High Stability (± 0.01ppm) internal ref.
- Z	Altenuator 0.1 dB Steps, Upconverter
- 5	0.5 MHz Frequency Steps
- X	125 kHz Step Size
- X1004	1 kHz Step, includes Option -H
Connector/Impedance	See Table 2.2 - PG 10

*+0 to +50 degrees C; Specifications subject to change without notice.

Communication Interface/Std. RS232	
- Q	RS485 Remote Interface
- W8	Ethernet; with Web Browser
- W18	Ethernet; with Web Browser & SNMP
- W28	Ethernet; with TCP/IP, Telnet®
Other	
- W15	ON/OFF Switch (Rear Panel Mounted)

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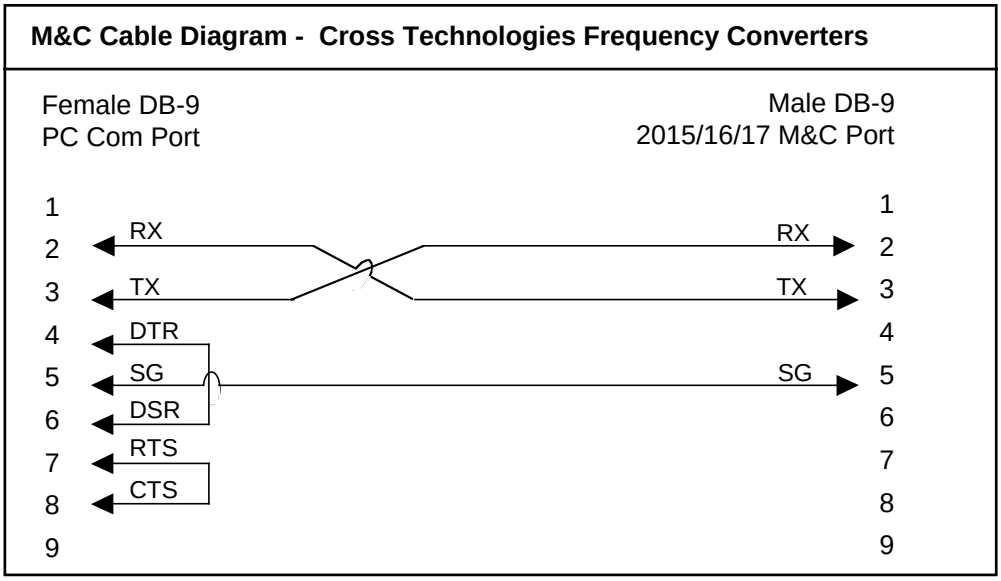
1.3 Monitor and Control Interface

A) Remote Serial Interface

Protocol - RS-485, RS-422 or RS232C (selectable), 9600 baud rate, no parity, 8 data bits, 1 start bit, 1 stop bit.



Connector: Rear panel, DB-9 male.

J10 Pinouts (RS-232C/422/485)	
Pin	**Function**
1	Rx-
2	Rx+ (RS-232C)
3	Tx+ (RS-232C)
4	Tx-
5	GND
6	Alarm Relay: Common
7	Alarm Relay: Normally Open
8	Not Used
9	Alarm Relay: Normally Closed

B) Status Requests - Table 1.1 lists the status requests for the 2015-25 and briefly describes them.

*** PLEASE NOTE: The two character {aa}(00-31) prefix, in the table below, should be used ONLY when RS-485, (OPTION-Q), is selected.**

Table 1.1 2015-25 Status Requests

Command	Syntax*	Description
Command Status	{aaS1}	Returns {aaS1bbbbccddAM)} where:
		• bbbb = Tx frequency (MHz)
		4 characters - standard -
		(7 characters - Option-X) (5 characters - Option-5)
		• Standard 1 dB step format: ccc = Tx gain (-10 to +30)
		• Z OPTION (0.1 dB steps): cccc = Tx gain (-100 to +300)
		• dd = Tx input level (10 to 40 => -10 to -40)
		• A = 0 if no alarm, 1 if summary alarm)
		• M = Tx RF Status (1 = Normal, 0 = Muted)
Command Status	{aaS2}	Returns {S2E} where:
		• E = Ext 10MHz Status (1 = on, 0 = off)

C) Commands Table 1.2 lists the commands for the 2015-25 and briefly describes them. After a command is sent the 2015-25 sends a return ">" indicating the command has been received and executed.

General Command Format - The general command format is {aaCND...}, where:

{ = start byte
aa = address (**RS-485 only - option Q**)
C = 1 character, either C (command) or S (status)
N = 1-digit command or status number, 1 through 9
D = 1 character or more of data (depends on command)
} = stop byte

*** PLEASE NOTE: The two character {aa}(00-31) prefix, in the table below, should be used ONLY when RS-485, (OPTION-Q), is selected.**

Table 1.2 2015-25 Commands

Command	Syntax*	Description
Set Transmitter Frequency	{aaC1xxxx}	where:
		• xxxx = 4 characters standard -
		(7 characters - Option-X) (5 characters - Option-5)
		• Range: 2000 to 2500 MHz
Set Input Level	{aaCIxx}	where:
		• xx = 2 characters
		• Range: 10 to 40 (-10 to -40 dBm, in 1 dB steps)
Set Transmit Gain	{aaC3xxxx}	where:
		• Standard 1 dB step format:
		- xxx = 2 char (0 to 30dB), or 3 char (-10 to -01dB) if neg.
		- Range:-100 to 300 (-10.0 dB to +30.0 dB, in 0.1 dB steps)
		• Z OPTION (0.1 dB steps):
		- xxxx=3 char(0 to 300dB),or 4 char(-100 to -001dB) if neg.
		- Range: -100 to 300 (-10.0 dB to +30.0 dB, in 0.1 dB steps)
Enable Tx	{aaCAx}	where x =:
		• 0 to disable Tx signal
		• 1 to enable Tx signal
Enable External 10MHz	{aaCEx}	where x =:
		• 0 to disable External 10MHz ref signal
		• 1 to enable External 10MHz ref signal
Enable Remote	#	Just # sign
Disable Remote	{aaCR0}	{CR and zero}

1.4 Environmental Use Information

A. **Rack-Mounting** - To mount this equipment in a rack, please refer to the installation instructions located in the user manual furnished by the manufacturer of your equipment rack.

B. **Mechanical Loading** - Mounting of equipment in a rack should be such that a hazardous condition does not exist due to uneven weight distribution.

C. **Elevated Operating Ambient Temperature** - If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack may be greater than room ambient temperature. Therefore, consideration should be given to Tmra.

D. **Reduced Air Flow** - Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised. Additional space between unit may be required.

E. **Circuit Overloading** - Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of circuits could have on over current protection and supply wiring. Appropriate consideration of equipment name plate rating should be used, when addressing this concern.

F. **Reliable Earthing** - Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connection to the Branch (use of power strips).

G. **Top Cover** - There are no serviceable parts inside the product so, the Top Cover should not be removed. If the Top Cover is removed the ground strap and associated screw MUST BE REINSTALLED prior to Top Cover screw replacement. FAILURE TO DO this may cause INGRESS and/or EGRESS emission problems.

2.0 Installation

2.1 Mechanical - The 2015-25 consists of one RF/Controller PCB housed in a 1 RU (1 3/4 inch high) by 16 inch deep chassis. A switching, ± 12, +24, +5 VDC power supply provides power for the assemblies. The 2015-25 can be secured to a rack using the 4 holes on the front panel. Figure 2.1 shows how the 2015-25 is assembled.

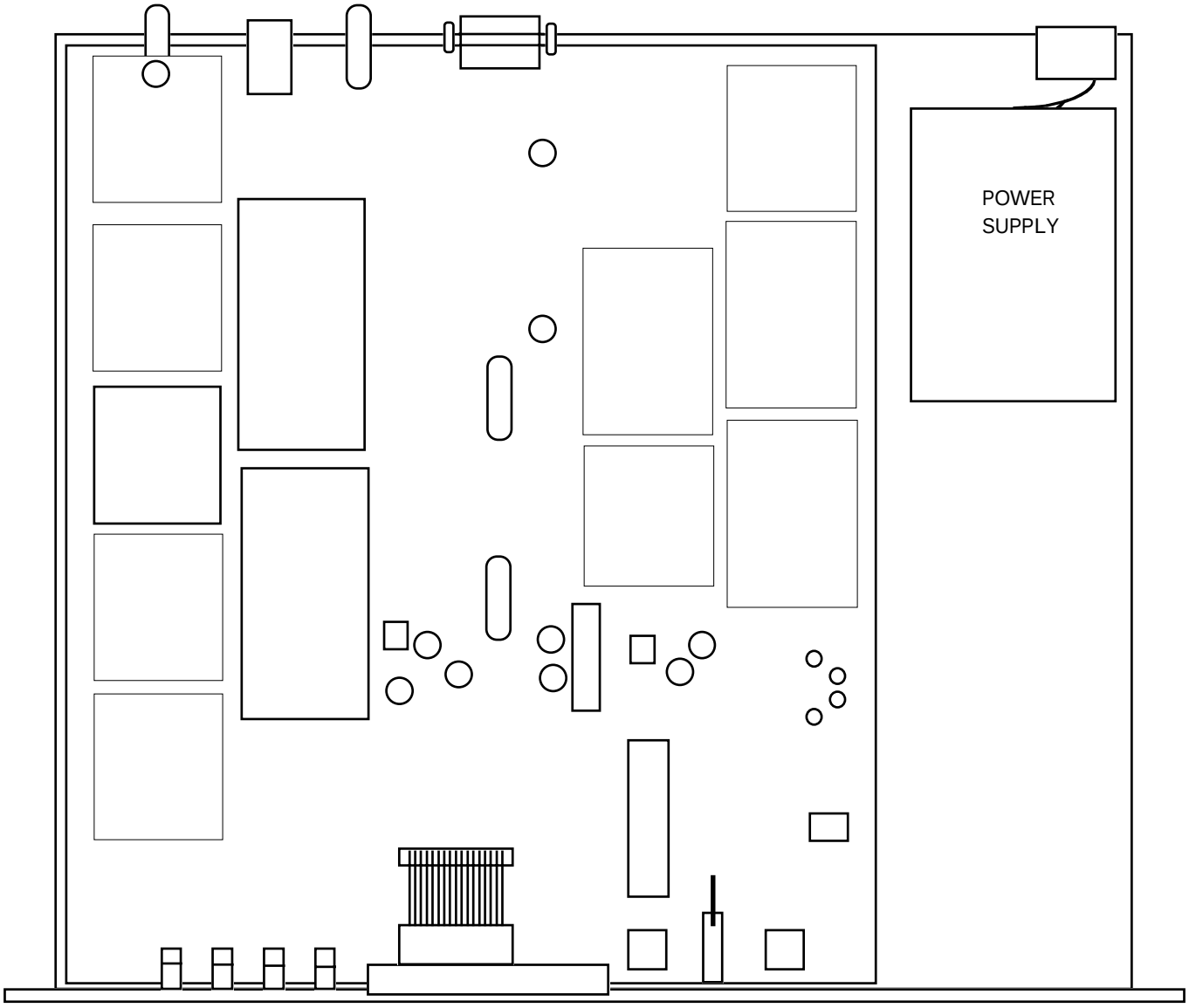


FIGURE 2.1 2015-25 Mechanical Assembly

2.2 Rear Panel Input/Output Signals - Figure 2.2 shows the input and output connectors on the rear panel.

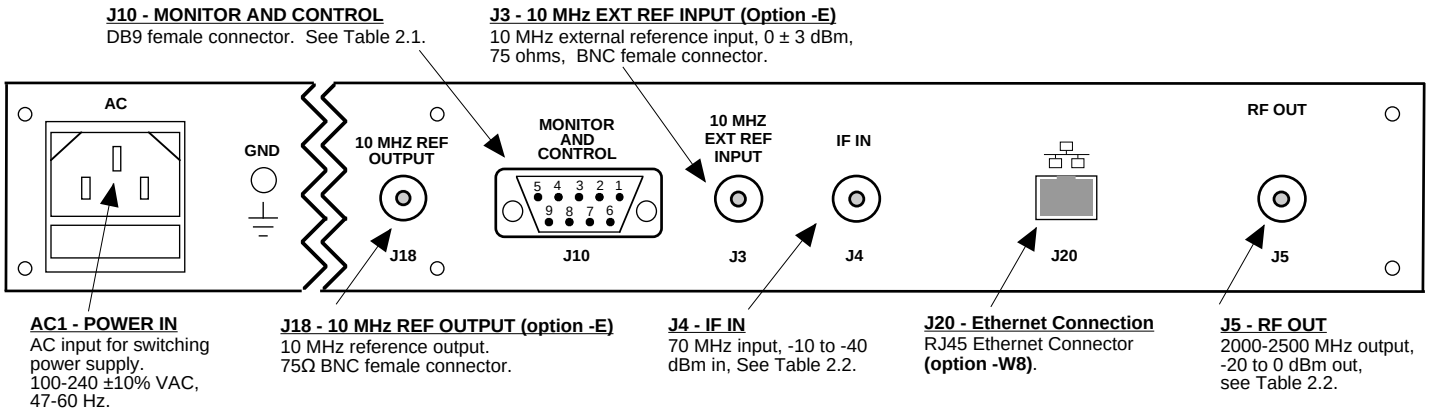

J10 - MONITOR AND CONTROL
DB9 female connector. See Table 2.1.
J3 - 10 MHz EXT REF INPUT (Option -E)
10 MHz external reference input, 0 ± 3 dBm, 75 ohms, BNC female connector.
AC
GND
10 MHZ REF OUTPUT
MONITOR AND CONTROL
10 MHZ EXT REF INPUT
IF IN
RF OUT
J18
J10
J3
J4
J20
J5
AC1 - POWER IN
AC input for switching power supply. 100-240 ±10% VAC, 47-60 Hz.
J18 - 10 MHz REF OUTPUT (option -E)
10 MHz reference output. 75Ω BNC female connector.
J4 - IF IN
70 MHz input, -10 to -40 dBm in, See Table 2.2.
J20 - Ethernet Connection
RJ45 Ethernet Connector (option -W8).
J5 - RF OUT
2000-2500 MHz output, -20 to 0 dBm out, see Table 2.2.

FIGURE 2.2-A 2015-25 Rear Panel I/Os - AC Input

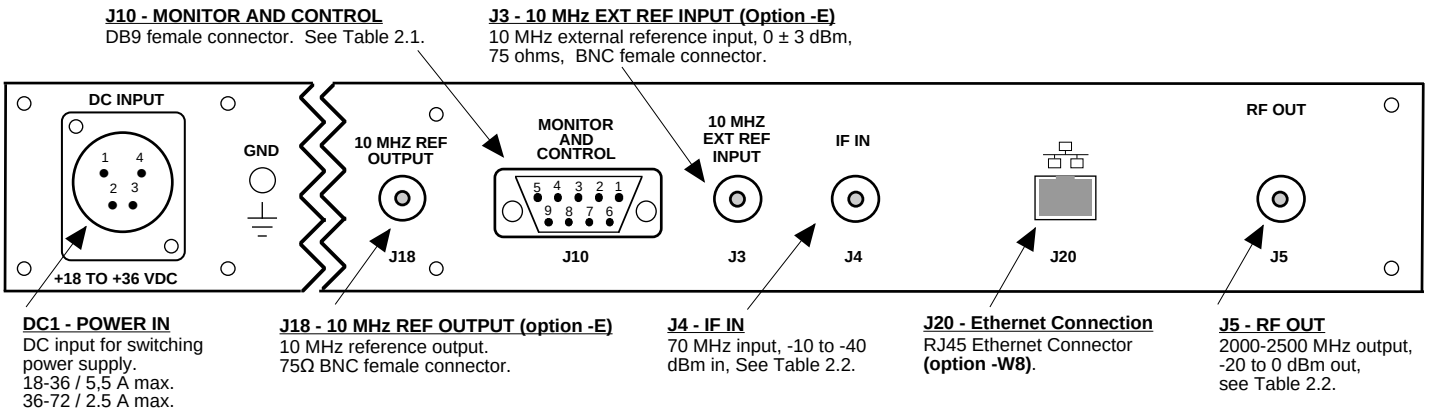

J10 - MONITOR AND CONTROL
DB9 female connector. See Table 2.1.
J3 - 10 MHz EXT REF INPUT (Option -E)
10 MHz external reference input, 0 ± 3 dBm, 75 ohms, BNC female connector.
DC INPUT
GND
10 MHZ REF OUTPUT
MONITOR AND CONTROL
10 MHZ EXT REF INPUT
IF IN
RF OUT
+18 TO +36 VDC
J18
J10
J3
J4
J20
J5
DC1 - POWER IN
DC input for switching power supply. 18-36 / 5,5 A max. 36-72 / 2.5 A max.
J18 - 10 MHz REF OUTPUT (option -E)
10 MHz reference output. 75Ω BNC female connector.
J4 - IF IN
70 MHz input, -10 to -40 dBm in, See Table 2.2.
J20 - Ethernet Connection
RJ45 Ethernet Connector (option -W8).
J5 - RF OUT
2000-2500 MHz output, -20 to 0 dBm out, see Table 2.2.

FIGURE 2.2-B 2015-25 Rear Panel I/Os - DC Input

TABLE 2.1 J10 Pinouts (RS-232C/422/485*)

Pin	Function
1	Rx-
2	Rx+ (RS-232C)
3	Tx+ (RS-232C)
4	Tx-
5	GND
6	Alarm Relay: Common
7	Alarm Relay: Normally Open
8	Not Used
9	Alarm Relay: Normally Closed

TABLE 2.2 IF/RF Connector Options

Option	IF	RF
STD	BNC, 75Ω	BNC, 50Ω
-B	BNC, 75Ω	BNC, 75Ω
-D	BNC, 50Ω	BNC, 50Ω
-N	BNC, 75Ω	Type N, 50Ω
-M	BNC, 50Ω	Type N, 50Ω
-SS	SMA, 50Ω	SMA, 50Ω

TABLE 2.3 DC1 Pinouts

Pin #	Function
1	Return/Ground
2	N/C
3	+18 - +36 VDC
4	N/C

***Remote Serial Interface**
Interface: DB-9 Male
Protocol: RS232C (RS232C/422/485 **option Q**),
9600 baud rate, no parity, 8 data bits,
1 start bit, 1 stop bit.

2.3 Front Panel Controls and Indicators - The following are the front panel controls and indicators.

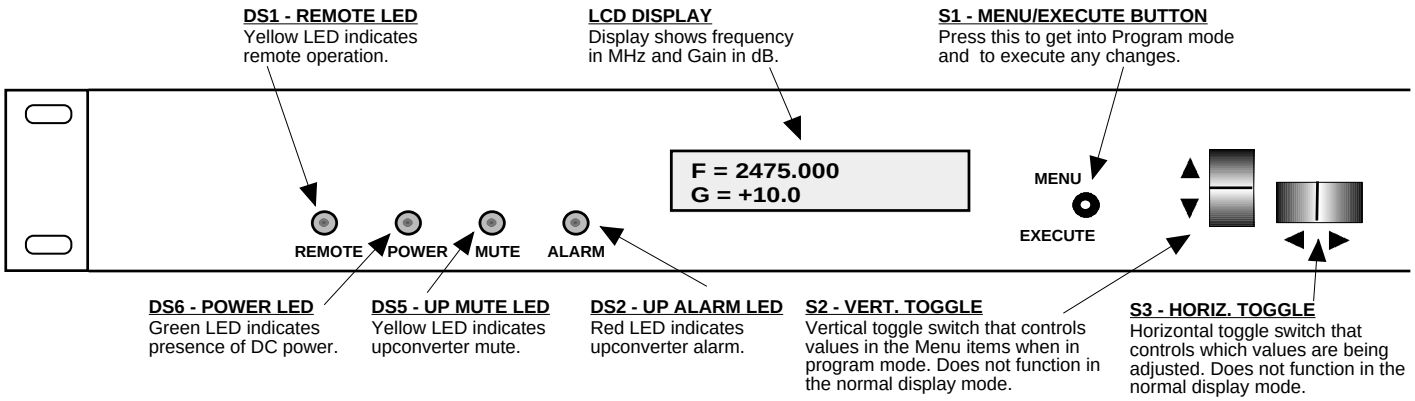

DS1 - REMOTE LED
Yellow LED indicates remote operation.
LCD DISPLAY
Display shows frequency in MHz and Gain in dB.
S1 - MENU/EXECUTE BUTTON
Press this to get into Program mode and to execute any changes.
F = 2475.000
G = +10.0
MENU
EXECUTE
REMOTE
POWER
MUTE
ALARM
DS6 - POWER LED
Green LED indicates presence of DC power.
DS5 - UP MUTE LED
Yellow LED indicates upconverter mute.
DS2 - UP ALARM LED
Red LED indicates upconverter alarm.
S2 - VERT. TOGGLE
Vertical toggle switch that controls values in the Menu items when in program mode. Does not function in the normal display mode.
S3 - HORIZ. TOGGLE
Horizontal toggle switch that controls which values are being adjusted. Does not function in the normal display mode.

FIGURE 2.3 2015-25 Front Panel Controls and Indicators

2.4 Operation

2.4.1 Installing and Operating the 2015-25 Upconverter

1. Connect a -10 dBm to -40 dBm signal to IF In, J4 (Figure 2.2)
2. Connect the RF OUT, J5, to the external equipment
3. Connect 100-20 ±10% VAC, 47 - 63 Hz to AC1 on the back panel.
4. Set the desired output frequency (See Section 2.5 Menu Settings).
5. Set the input level (See Section 2.5 Menu Settings).
6. Set the gain for -10 to +30 dB. Make sure the output stays within -20 to 0 dBm with the gain selected and the input level provided. The firmware will prevent setting gain and input level outside this range. (See Section 2.5 Menu Settings).
7. Be sure DS6 (green, DC Power) is on and DS2 (red, Alarm) is off (Figure 2.3).
8. AC Fuse - The fuse is a 5 mm X 20 mm, 2 amp slow blow (Type T) and is inserted in the far slot in the drawer below the AC input as shown in Figure 2.4. There is a spare fuse in the near slot. If a fuse continues to open, the power supply is most likely defective.

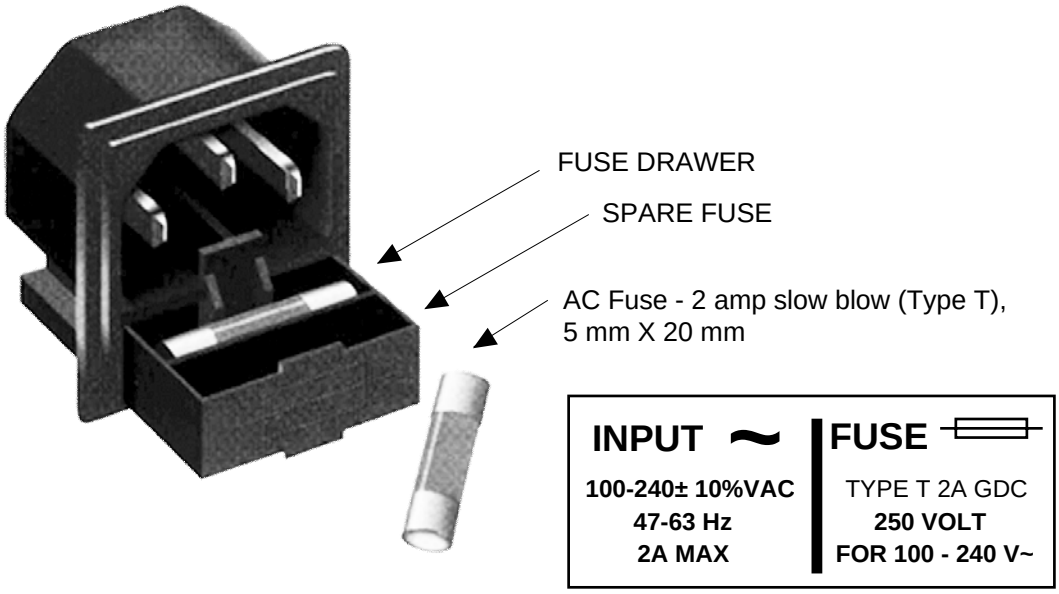


FIGURE 2.4 Fuse Location and Spare Fuse

2.5 Menu Settings

2.5.1 Functions

This section describes operation of the front panel controls. There are three operator switches, the LCD display and alarm indicator LEDs. All functions for the equipment are controlled by these components. The functions are (See Figure 2.5):

Power Up
Normal Display

Menu 1 Frequency in MHz
Menu 2 Input Lvl (Set from -40 to -10)
Menu 3 Gain (-10 to +30)
Menu 4 Mute
Menu 5 Set Unit to Remote Operation (NOTE: the local controls still function when in REMOTE)
Menu 6 Select External 10 MHz Ref (**option E**)
Menu 7 Set Remote Mode (**option Q**)
Menu 8 Set RS-485 Address (**option Q**)

Save Menu When "R" is selected or at the end

Alarm indications appear on the LEDs (See figure 2.3).

All program changes must start with the operation of the Menu/Execute switch and must also end with the operation of the Menu/Execute switch verified by the "Save Settings?" Menu. If this sequence is not followed, none of the changes will take effect. If programming is initiated and no operator action takes place for approximately 12 seconds (before the final press of the Menu/Execute switch) the display will revert to its previous status and you will need to start over.

2.5.2 Power On Settings

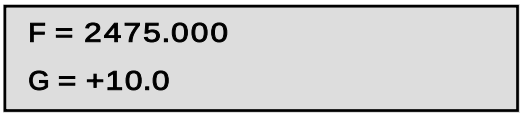
NOTE: THE LAST STATUS OF A UNIT IS RETAINED EVEN WHEN POWER IS REMOVED. WHEN POWER IS RESTORED, THE UNIT WILL RETURN TO IT'S PREVIOUS SETTINGS.

When power is first applied, the LCD display goes through three steps.

1.The LCD goes black to show all segments are functioning.

2.The software version will be displayed.

3.The present frequency and gain of the upconverter is shown.



The unit is now operational and ready for any changes the operator may desire.

2.5.3 Control Switches

1. Menu/Execute - Any change to the programming of the unit must be initiated by pressing the Menu/Execute switch and completed by pressing the Menu/Execute switch.
2. Horizontal Switch - This switch is mounted so its movement is horizontal and moves the cursor left or right.
3. Vertical Switch - This switch is mounted so its movement is vertical and has two functions:
   a. During frequency, gain changes, the vertical movement will raise or lower the number in the direction of the arrows.
   b. For other functions such Mute on/off, the vertical switch will alternately turn the function on or off regardless of the direction operated.

2.5.4 Frequency Changes

At any time during the modification process, if you have made a mistake and do not wish to save the changes you have made, **do not press the Menu/Execute switch**; simply do nothing for approximately 12 seconds, and the system will return to the normal operating mode or scroll to **"R"** and push the menu/Execute switch and select **"NO"** in the **"SAVE SETTINGS?"** window.

To change the FREQUENCY:

Operate the Menu/Execute switch until you get to the menu item you want to change. See Figure 2.5 for the sequence of menu options. The following display is for changing the upconverter frequency:

```
F = 2350              R
```

Pressing the Up/Down switch down will toggle the display to:

```
F = 2450              R
```

By using the horizontal rocker switch the cursor can be moved left or right.

```
F = 2450              R
```

NOTE: CHANGES DO NOT TAKE PLACE ON FREQUENCY UNTIL YOU GO TO THE SAVE MENU AND INDICATE YOU WANT TO SAVE THE CHANGES. THE CARRIER IS MUTED WHEN FREQUENCY IS CHANGED.

When the display indicates the value desired you can push the Menu/Execute switch to the next item:

```
INLVL = -20           R
```

OR you can scroll to "R", push the Menu/Execute switch to get to:

```
SAVE SETTINGS?      Y N
```

Selecting **Y** will save the new settings. Selecting **N** will revert to the previous settings.
Pushing the Menu/Execute switch then takes you to this:

```
F=2450    G=+10.0
```

Figure 2.5 gives the menu items and how to make changes.

2.5.5 Gain Changes

When you get to this menu note that the gain changes will be made as you make them but if you do not wish to save the changes you have made, scroll to **"R"** and push the menu/Execute switch and select **"NO"** in the **"SAVE SETTINGS?"** window or **do not press the Menu/Execute switch**; simply do nothing for approximately 12 seconds, and the system will return to the normal operating mode.

The following display is for changing the upconverter input level. This is an important setting to optimize spurious and should be made as accurately as possible:

```
INLVL = -20          R
```

NOTE: CHANGES TAKE PLACE ON LEVEL AND GAIN IMMEDIATELY BUT DO NOT GET SAVED UNTIL YOU GO TO THE SAVE MENU AND INDICATE YOU WANT TO SAVE THE CHANGES.

Pressing the Up/Down switch to change the level in 1 dB steps and then push the Menu/Execute switch to get to the Gain setting:

```
G = +10              R
```

Pressing the Up/Down switch to change the gain in 1 or 10 dB steps and then push the Menu/Execute switch to get to the Gain setting:

```
G = +20              R
```

By using the horizontal rocker switch the cursor can be moved left or right .

Pressing the Up/Down switch down will toggle the display digit selected until you have the desired gain.

NOTE: THE GAIN WILL BE CHANGED AS YOU ADJUST THE NUMBERS. HOWEVER, THE VALUE WILL NOT BE STORED UNTIL YOU INDICATE YES IN THE SAVE SETTINGS WINDOW. DO NOT SET A GAIN THAT WOULD EXCEED 0 dBm OR HAVE LESS THAN -20 dBm OUTPUT LEVEL. THE FIRMWARE PREVENTS YOU FROM THIS.

When the display indicates the value desired you can push the Menu/Execute switch to the next item OR you can scroll to "R", push the Menu/Execute switch to get to:

```
SAVE SETTINGS?      Y N
```

Selecting **Y** will save the new settings. Selecting **N** will revert to the previous settings.

Pushing the Menu/Execute switch then takes you to this:

```
F=2450    G=+20.0
```

Figure 2.5 gives the menu items and how to make changes.

2.5.5 Alarm Indications

An alarm condition for will occur if any local oscillator phase lock loop (PLL) comes out of lock.
The Mute LED will light if you select Mute and the Remote LED will light when you select the Remote mode.

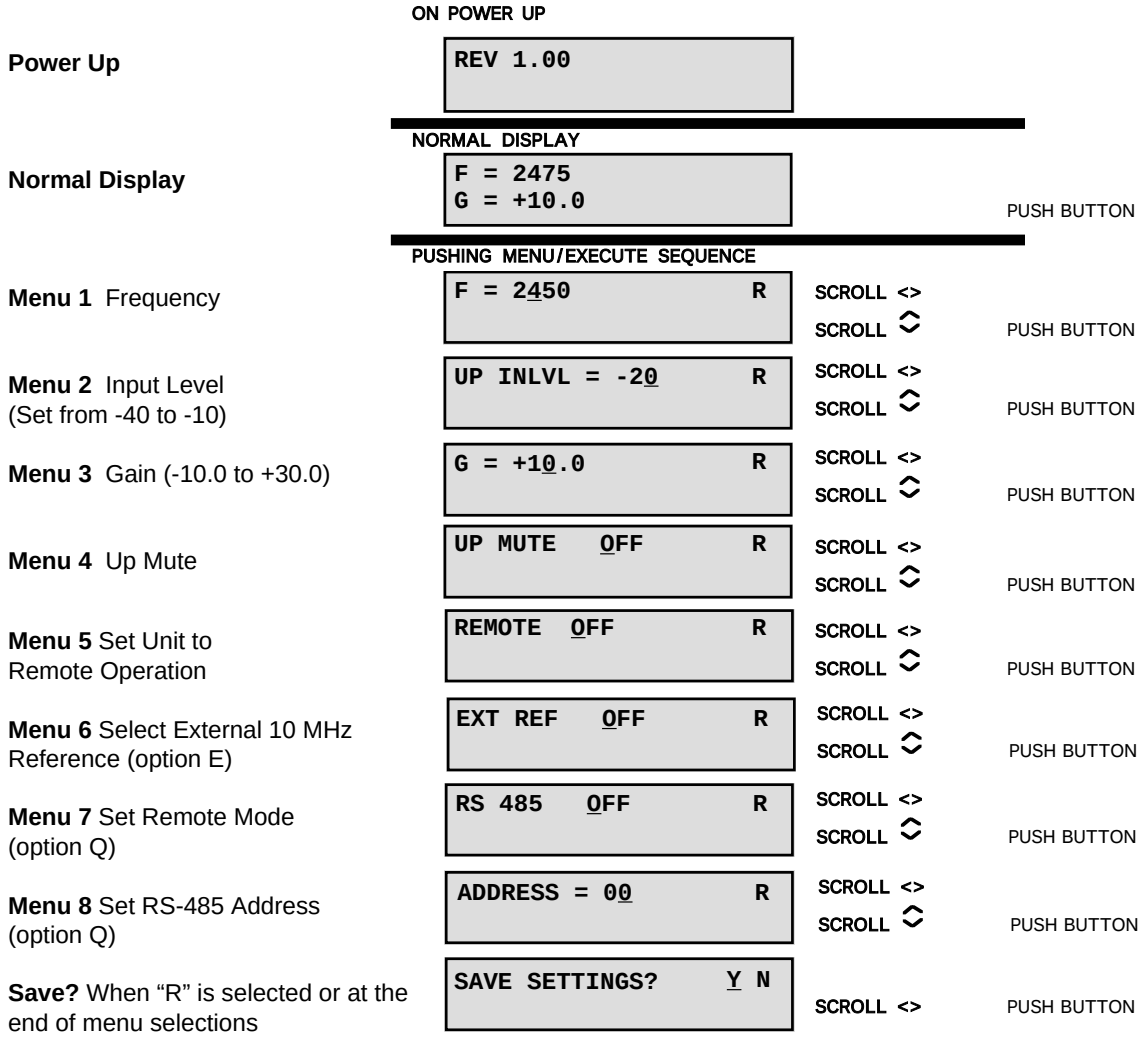
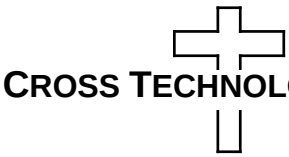


FIGURE 2.5 Menu Display and Sequence



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